JOURNAL OF ELECTRICITY

POWER AND GAS

Devoted to the Conversion, Transmission and Distribution of Energy

Entered as second class matter May 7, 1906, at the Post Office at San Francisco, Cal., under the act of Congress March 3, 1879.

VOL. XXXVII NO. 9 | SAN FRANCISCO, AUGUST 26, 1916 | PER COPY, 25 CENTS

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXVII SAN FRANCISCO, AUGUST 26, 1916 NUMBER 9

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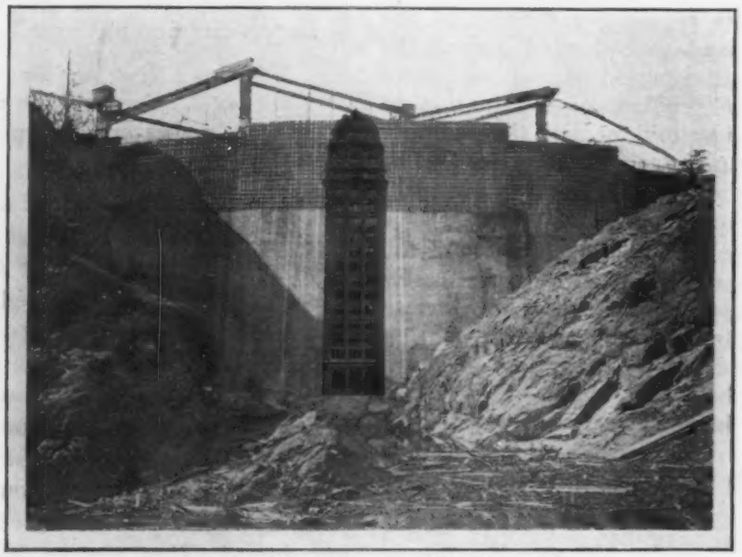
Lake Spalding and Its Impounded Waters.

THE FRUITAGE OF PRACTICAL CONSERVATION

BY ROBERT SIBLEY.

During the past decade, while the public has noted with increasing satisfaction the growth of industrial and agricultural activity throughout the West, little actual credit has been given to one phase or side issue of hydroelectric development that year by year will extend its usefulness and indeed some day may be verified again the old proverb which says "The child has become the father of the man." Reference is made to the dual use of water made possible by the vast storage systems of Western hydroelectric companies.

There appeared recently in the daily papers of the West a brief announcement, for instance, that the Pacific Gas & Electric Company of Central California is to enlarge its Spalding dam by raising its present crest an additional 35 ft. By reference to the illustrations accompanying this article, the reader will gain at once some conception as to what this means for conservation of waters throughout all posterity. And yet this is but one illustration of many that may be cited in Western undertakings. The Spalding dam is already 275 ft. in height, and its new height of 310 ft. will place it as a world record-breaker for depth of artificial waters impounded.



The Spalding Dam Under Construction.
(The giant height is strikingly shown by comparison with the Humboldt Savings Bank building, San Francisco.)

No complete data are available to set forth the vast reclamation of arid lands that are being made possible by such storage of waters under private enterprise, nevertheless in such instances as this the water is not only used many times over for power purposes, but finally it finds its resting place in the fertile soils of Western valleys under improved irrigation methods.

Of all the notable

conventions which met at the Panama-Pacific International Exposition, that of the Irrigation Congress will perhaps go down into history as best setting forth the progress of human endeavor in a manner that reaches the heart of man. Home building and creative productivity of the soil are after all the objects of human effort most treasured in the human breast.

Scarcely thirteen years have passed since the reclamation and irrigation legislation of Congress became a law. In this brief space of time over 9000 miles of canals have been dug; 26 miles of tunnels excavated; sufficient water stored in giant reservoirs to flood an area of 6,000,000 acres one foot in depth; 785 miles of wagon roads; 88 miles of railroads and 2500 miles of telephone lines have been built in isolated communities; and best of all 3,000,000 acres of land made available for settlement. During the year 1914, for instance, the value of crops raised on that portion of these lands now under cultivation amounted to $16,500,000. The acreage actually cropped was 703,424. Hence we may easily compute the gigantic return in actual creative wealth that will eventually take place when these lands are settled to their ultimate capacity. In addition to these governmental activities, countless thousands of small reclamation projects have been put through by private enterprise throughout the Pacific Coast states.

Practically every mechanical and structural device known to modern invention has been made use of in conserving the waters and in putting the latent powers of these waters to their best use. Broadly speaking, the reclamation art consists in storing the vast flood waters of western streams so that they may be properly and scientifically applied in watering the arid lands tributary to them, thus making these lands productive for the wants of man. In certain instances the flood waters are so stored in favorable reservoirs that these gigantic bodies are harnessed to drive the industries of thriving communities before the water is later applied in irrigation. In still other communities some of the most fertile lands in the world are found along the bottoms of the great rivers of the West. As these rich lands are flooded during the rainy season, or during the period of melting snows in the high Sierras, the problem of reclamation in such instances becomes two-fold, namely the pumping of the water from the lands during certain seasons of the year and the pumping of the water back again upon the lands during the irrigation period.

In most of the larger reclamation projects of the West, the water is first stored in large natural reservoirs by the constructing of high dams. The water so conserved is then turned back into the stream during the dry period and taken out for irrigation purposes, oftentimes many miles below.

In some instances, however, a gravity system of flow is not possible. In such cases the water is pumped from the stream upon the lands desired to be irrigated.

This problem of pumping has developed into a gigantic industry in the great central and southern valleys of California and in the fruit producing sections of the Northwest. Recent years have divulged the fact that many of the Western valleys are literally honey-combed with underground waters. This has made possible the individual electric pumps for thousands of ranches, since, in such an event, there is no cost of up-keep for irrigation canals and since low electric power rates are available; power companies have thus found a new and profitable source of power application. One company alone in central California furnishes over 60,000 electrical horsepower to small irrigators in the operation of pumps.

This combination of power development and water conservation is indeed developed to a high degree. In Southern California, for instance, the water conserved in the Bear Creek reservoirs located upon the head waters of the Santa Ana River passes through four successive power plants before it issues out into the open valley, exhausted in power possibilities but ready for application in irrigating the fertile orange groves dependent upon this stream for their very life energies.

Oftentimes the location of reservoirs is in such an out-of-the-way locality that the ingenuity of the constructing engineer is tested to the utmost in devising methods of transporting the machinery and materials of construction into the country. Thus the building of the road to the site of the Roosevelt Dam necessitated the blasting of a sheer cliff for long distances and proved one of the most complicated tasks in the construction of the Salt River project.

Nevertheless, the thousands of happy homes that now dot the plains, formerly available only for sage brush and the jack rabbit, attest the wonderful fruitage that is now observable on all sides, which points to the substantial success of these undertakings. Even the snow-decked electric trains that whiz out upon the thickly settled reclamation communities of the Northwest bear testimony to the content and prosperity of the settlers.

Thus it is, by these gigantic publicly built structures, coupled with innumerable smaller privately owned enterprises, that the "Great American Desert" of forty years ago has now become one of the richest portions of our country.

YOUR REAL BOSS IS THE CUSTOMER.

The superintendent of a big department store in Boston conducts a school of salesmanship in his establishment, and one of the first questions he puts to his class of beginners is: "Who is the boss?" After salesmen pupils have guessed every official about the establishment, the superintendent explains. "No, no, no; he is not the boss. The real boss in this store is the customer. It's the customer that you and I are here to please. It's the customer who pays your wages and mine. Now, if you are sitting behind your counter, doing nothing, and you see me coming, don't jump up; but if you see the customer—the boss—coming, jump! That always makes a deep impression. The lesson is a good one to memorize. It applies to the electrical business as well as any other.

ELECTRIC POWER FOR IRRIGATION PUMPING

DEPARTMENT CONDUCTED BY S. T. HARDING

AN AIR LIFT PUMPING PLANT.

Water for the irrigation of lands in the vicinity of Pomona has been pumped from 18 wells by means of air lifts by the irrigation company of Pomona for the past 16 years. The following data regarding the plant and the operation results were secured from Mr. C. H. Hardon, the engineer of the company.

The equipment consists of a cross-compound condensing Corliss engine direct connected to duplex air compressors. Titus air lifts are used in the wells. Steam is generated by two 100 h.p. return tubular boilers using fuel oil. Including auxiliaries the steam consumption is about 22 pounds per h.p. hour when operating at ¾ load. The displacement of the compressor pistons when running at 100 revolutions per minute is 1200 cubic feet or 1080 cubic feet per minute at the average actual speed.

The wells vary from 200 to 970 ft. in depth. Seven inch casings are used on most of the wells, two, however, being 14 inch. The air lines into the wells are four inch pipe. The total capacity of the 18 wells is about 300 inches, although 360 inches have been secured for short periods. The depth to water in different years varies quite widely; in some years some of the wells have flowed. The water actually pumped varies with the demand, the average for 1915 was 258 miners' inches, or slightly over 5 second feet.

The regulation of the air pressure for each well is made at the outlet of the air pipe in the well by means of a long stemmed valve operating from the surface. These valve stems have 12 threads to the inch and are turned by a hand wheel having six spokes. This permits very close regulation, the pressure in each well being adjusted to the lift. This adjustment is made by the "feel" of the well, obtained by observation and experience of the operator. Variations in the pressure are shown in the character of the discharge of the well and adjustments made until the desired result is obtained. This adjustment has to be changed during the season due to variations in the height of the lift and the amount of water being pumped. A second valve at the surface is also provided so that a well can be shut off without changing the setting of the valve in the well.

Air is transmitted to the wells at a pressure of 60 to 65 pounds. Relatively large pipes are used and the line losses are small.

About 2500 acres are supplied by this system, part of the area being in the city of Pomona. Probably over one-half of the land irrigated is in citrus groves, the remainder consisting mainly of alfalfa, garden truck and small fruits.

Tests were made on this plant in 1905 by the U. S. Department of Agriculture, the results of which are given in Bulletin 181 of the office of Experiment Stations by J. N. Le Conte and C. E. Tait. These tests consisted of indicator card tests on the steam engine taken at half-hour intervals over a 6 hour period and a test on the air cylinders. It was found to be practically impossible to measure the lift directly on the 12 wells being pumped at the time of the test. The head was computed from the known air pressure at the wells and the length of the air pipe. The resulting head is considered liable to an error of about 10 per cent. The water pumped averaged 4.62 second feet or 231 inches. Based on the 133.7 total indicated horsepower of the engine the 22.0 useful water horsepower developed represents an efficiency of 16.5 per cent. The mechanical efficiency of the compressor was found to be 78 per cent. Based on the power output of the air cylinders the efficiency of the air lifts was 21.1 per cent. The plant of the Del Monte Irrigation Company was also tested at the same time and gave an efficiency of 17.9 per cent based on the indicated horsepower of the engine and 19.5 based on the indicated horsepower of the air cylinders, the mechanical efficiency of the compressors at this plant being 91.5 per cent. Tests of the Pomona company's plant made by Mr. Hardon when operating more nearly to capacity under favorable conditions, have given efficiencies of 28 to 30 per cent for the compressor and air lift.

The operation season extended from May to October. The cost of oil in 1915 was 75 cents per barrel.

The summary of the pumping operations for 1915 as furnished by Mr. Hardon is as follows:

Total hours run	2,798
Total gallons pumped	389,386,300
Average gallons per 24 hours	3,340,600
Total barrels oil used	2,141.5
Average barrels oil per 24 hours	18.36
Average gallons pumped per barrel oil	181,950
Average gallons pumped one foot per barrel oil	3,325
Average miners' inches pumped	258
Cost of fuel oil	$1,611.30
Cost of engine oil	$16.90
Cost of attendance	$930.00
Cost of supplies, lights and waste	$33.80
Total operation cost	$2,592.00
Cost of operation per 60-in. head per hour	$0.215
Cost of operation per inch per hour	.0036
Cost of operation of plant per hour	.926

The costs given are for operation only. The pumping plant is reported to have cost $37,200. This includes the equipment, air lines and building but not the wells. This plant has been in use 16 years and is still giving good service. While somewhat improved machinery might be secured at present, the plant has a considerable remaining useful life and an estimated depreciation of 4 per cent per year would seem to be reasonable. If an interest rate of 6 per cent is assumed, the interest and depreciation will amount to $3720 per year.

The quantity pumped in 1915 equals 1203 acre feet. The average lift is stated to be 60 ft. or possibly somewhat more as it can not be obtained definitely. On this basis the following unit costs can be obtained from the totals previously given:

Unit Cost of Pumping With Air Lift—Irrigation Company of Pomona, for 1915.

	Cost per acre foot raised one foot.	Cost per miners' inch per 24 hr. per foot of lift.
Cost of oil	$0.2223	$0.00989
Other operation expenses	.0137	.00055
Interest and depreciation	.050	.00200
Total	$0.086	$0.00344

The acre-feet raised 1 foot per barrel of oil used was 33.7 and the miners' inches per 24 hours raised 1 foot per barrel of oil was 842.

The other operation expenses in 1915 consisted almost entirely of attendance at the plant. No costs for maintenance and repairs were given for 1915. For average years some additional cost should be added to cover such items.

While the efficiency of these air lifts is low as compared with that which may be obtained with other types of pumps, they are well adapted for the conditions obtaining in this plant. For 18 wells scattered over a distance of a mile or more yielding an average of less than 20 inches per well, and having lifts varying from flowing to over 60 ft., the air lift has many advantages.

One advantage in the use of air lifts has been the low cost of maintenance of the pumping equipment and wells. For the 16 years of operation it is stated that the expenses directly in connection with the wells has not exceeded $100.

DUAL USE OF STORED WATER.

The question as to whether a power company or an irrigation district can use the waters of a stream which it has stored, at its own expense, for more than one purpose, in other words, make a second use of the water, is a phase of the state's many complex problems which recently came before the California Water Commission in a joint application made by the Utica Mining Company and the Hobart Estate Company and the Oakdale Irrigation District of Stanislaus county. There is no Supreme Court adjudication on the question, but there appears on the other hand, to be no valid reason why the same individual, company or district may not generate power with water it has stored, and then use the same water for irrigation purposes. In other words, the potentiality of the water is not confined to any single use, but is of as many combined uses as can be made of it in compliance with the laws governing the appropriation and use of the public waters of the state. All the state asks is that the water be put to 'beneficial use.'

The Oakdale Irrigation District, in conjunction with its neighbor, the South San Joaquin Irrigation District, lays claim to all the hitherto unappropriated waters of the natural flow of the Stanislaus River. But the flood waters of the stream and its watershed, a vast quantity, go to waste annually. The only way to practically make use of this is by storage behind expensive dams. The Oakdale District comprises some 75,000 acres, only 15,000 of which are now irrigated. More water must be had, as the district develops. An agreement was entered into between the three parties to share the expense of the big proposed dam and reservoir at Spicers Meadows, the irrigationists to have the water after its use for generating power. The district was, however, not ready to proceed with the financial end, and fearing to lose the desired water, asked for a ruling by the water commission, to the effect that any persons storing water and using same for the development of power, be compelled to turn said water back into the stream, to be appropriated by persons below on whose lands it might be beneficially used.

A conference of the water commission members with the directors of the Oakdale District was held a few days ago. It developed that while the Utica people might enter into such an agreement for the storage and appropriation of waters, as was proposed, there was, on the other hand nothing to prohibit a like agreement with others, in case the Oakdale District was not agreeable to proceed jointly with the Utica Company. There are other thousands of acres which can be watered from the Stanislaus stored waters and nothing would prevent the owners of the same from entering into an agreement with the power people, to the exclusion of the Oakdale District.

It has also developed that there seems to be no hindrance to the selling of stored waters to others for a second use if same are put to beneficial use, even though the buyers have not participated in the original expense of storage. Subsequent purchasers do participate in the expense later on, through the price they pay for the use of the water, based on the rates paid by them under the public utilities act. A case that has just come to hand, is that of the farmers of the Lincoln, Sheridan and Roseville Sections of Placer county, signing up contracts with the Pacific Gas & Electric Company, to purchase stored water, which will be primarily used for the generation of power and then turned into flumes and canals to be carried to the thirsty lands. In fact, the Oakdale District itself has already set a precedent, by an arrangement with the Sierra & San Francisco Power Company, for the use of water stored by that company and used first for power.

That an irrigation district would have the same right to use whatever of its water it desired for the generation of power first and irrigation afterward, does not seem to be disputed. Some time ago, a suggestion was seriously broached to one of the large irrigation districts of California that it utilize the fall of its water at the dam for the generation of electricity to be sold throughout the district for farm lighting and operation of farm machinery.

The conference between the water commission and the irrigation directors, proved to be in line with the policy of the commission to discuss freely and frankly with the people all matters arising over which there may be misunderstanding, thereby avoiding, where possible, interminable dispute and long and costly litigation. Following the meeting, it was agreed that the joint application of the Utica and Hobart people with the Oakdale Irrigation District should stand, that the irrigation district should participate in the storage scheme and share the storage expense as soon as the district was in shape to do so. Considerable delay will be occasioned in securing the storage concessions from the U. S. government. The commission will grant sufficient time and both interests hope to work out their joint proposition satisfactorily.

OIL PIPE LINES TO BE DOUBLED IN CAPACITY.

Improvements totaling $1,500,000 on the Associated Pipe line between Bakersfield and Mendota, and installation of new equipment on 14 old stations between Mendota and San Francisco, will be completed late in August. The improvement service will double the capacity of the pipe lines.

PROPERTIES OF IRON AND STEEL WIRES AND CABLES.

BY CLEM A. COPELAND.

(This installment of Mr. Copeland's series of articles on skin effect shows the inter-relationship of tensile strength, size of wire and specific resistance for iron and steel wires and cables. These data, in connection with curves to be published later, give all the information necessary for calculating the impedance due to skin effect.—The Editor.)

The data and curves of Figs. 11 and 12 were prepared from standard tables, wherewith Table VI was compiled in a more consistent manner than catalogue data, so that the nests of curves would be consistent throughout. Table VI will be found to be slightly

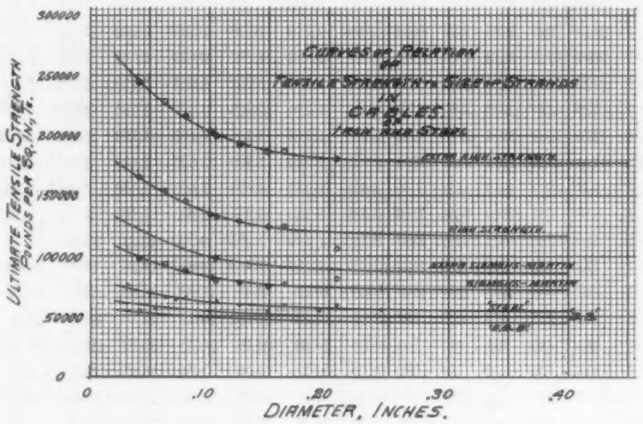


Fig. 11.

different from catalogue tables, although probably no more correct. Any company will be found ready however, to supply wires and cables of the qualities outlined in Table VI as readily and accurately as the qualities of those in their catalogues. In fact, the manufacturer, by the process of drawing and heat treatment or annealing together with chemical means, may produce any kind of characteristics within reasonable limits, varying the (μ, **H**,) and therefor the ($\mathbf{K_R}$, **I**) curves at will. In fact, the same may be said of copper and aluminum conductors to a more limited extent, but the almost universal use of these metals as conductors has quite thoroughly standardized their properties, to a less extent, however, than is usually appreciated, as variations of from 5% to 7% in resistance to d.c. currents from the standard tables are often found in the field.

Table VI will be found to differ considerably as regards d.c. resistances from J. A. Roebling's Sons Co.'s handbook of 1897 and 1900, which engineers have used for several years, although the data contained therein seems to follow present practice as closely as more recent tables or Table VI.

Iron and steel wires are much less standard than copper in their qualities and variations of 10% from any of the above mentioned tables and the curves of this paper may be occasionally expected. On the other hand, considering the variations in diameter, weight, tensile strength and resistance of iron wires of the same trade name measured in the field, the writer has been surprised to find how consistently the finally derived results agree with practice when these variations are taken into consideration. For instance, a so-called E.B.B. conductor actually measured in the field and found to have a d.c. resistance half way between "E.B.B." and "B.B." material as regards resistance will be found to have ($\mathbf{K_R}$, **I**) and ($\mathbf{K_L}$, **I**) curves about half way between the corresponding curves of the two materials. This relation seems to be established within reasonable accuracy. The specific resistances ρ in absohms or C. G. S. units of resistance per centimeter cube used in compiling Table VI are the the following:

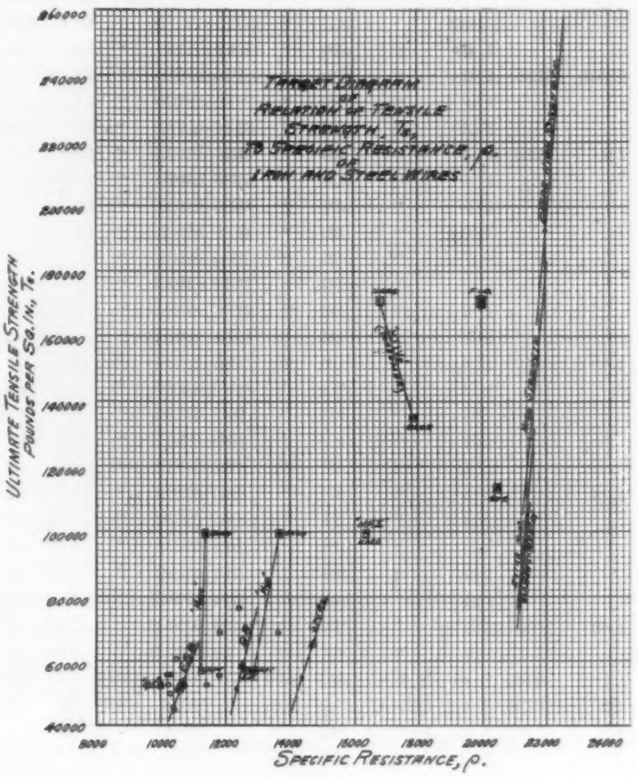


Fig. 12.

For Single Wire Conductors.

"EBB" (Telephone) Iron.	"BB" (Telephone) Iron.	"Guy" Cable Steel.	Siemens-Martin Steel.	Extra Siemens-Martin Steel.	High Strength (Crucible) Steel.	Extra High Strength (Plow) Steel.
10350	12310	14320	21150	21280	21500	22000
For 7, 19, 37, 61 Wire Conductors.						
10510	12415	14600	21255	21367	21650	22215

The latter are assumed to have a higher resistance due to drawing to accurate size and due to the stranding process, as shown in Fig. 11. The resistance $\mathbf{R_{dc}}$ per 1000 ft. in ohms is given by $4.724\ \rho/10^9\ \mathbf{A}$, where **A** is the area in sq. in. The following stranding factors are used in Table VI. Area of cross-section of conductor = number of strands × area of each strand for calculating tensile strengths.

Weight of stranded cables equals—

7.0586 × weight of each strand, for 7 strand cable.
19.3818 × weight of each strand, for 19 strand cable.
37.867 × weight of each strand, for 37 strand cable.
62.513 × weight of each strand, for 61 strand cable.

The d.c. resistance of stranded cables is taken as 1/7, 1/19, 1/37 and 1/61 of the resistance of a single strand with 1% added in each case as a stranding factor.

In order to show the variations of products found in the open market, some examples of actual measurements are given.

TABLE VI.

Nominal Diameter of Conductor. Inches. Fractional	Decimal	Number of Wires per Conductor.	Size of Wires No.	Gage.	Actual Diameter Of Each Wire. Inches.	Of Conductor.	Area. Of Each Wire. Cir. Mils	Of Each Wire.	Of Conductor.	Weight per 1000 ft. Pounds	Ultimate Tensile Strength. Pounds. EBB (Telephone) Iron.	BB (Telephone) Iron.	Steel (Telephone)	Siemens-Martin Steel.	Extra Siemens-Martin Steel.	High Strength Steel.	Extra High Strength Steel.	Resistance per 1000 Ft. At 20° C or 59° F. Ohms. EBB (Telephone) Iron.	BB (Telephone) Iron.	Steel (Telephone)	Siemens-Martin Steel.	Extra Siemens-Martin Steel.	High Strength Steel.	Extra High Strength Steel.
29/64	.45312	1	0000	B.W.G.	.454	Same	206116	.161883	Same	549.8	7375	8270	8915	11600	14000	18990	28700	.3023	.3597	.4185	.6180	.6220	.6280	.6435
		1	000	"	.425	"	180625	.141863	"	481.8	6455	7240	7805	10170	12270	16630	25150	.3450	.4105	.4770	.7050	.7125	.7170	.7340
		1	00	"	.380	"	144400	.113411	"	385.1	5163	5790	6245	8150	9825	13300	20120	.4310	.5130	.5965	.8820	.8875	.8960	.9175
11/32	.34395	1	0	"	.340	"	115600	.090792	"	308.3	4138	4634	4965	6515	7850	10635	16090	.5380	.6410	.7440	1.100	1.107	1.118	1.144
		1	1	"	.300	"	90000	.070686	"	240.0	3223	3609	3867	5075	6130	8310	12550	.6915	.8225	.9550	1.414	1.423	1.437	1.470
		1	2	"	.284	"	80656	.063347	"	215.1	2888	3234	3465	4500	5500	7400	11275	.7715	.9190	1.067	1.577	1.588	1.603	1.640
1/4	.25000	1	3	"	.259	"	67081	.052685	"	178.9	2400	2688	2880	3803	4580	6220	9430	.928	1.105	1.283	1.896	1.909	1.928	1.973
		1	4	"	.238	"	56644	.044488	"	151.1	2028	2271	2433	3240	3885	5275	7955	1.099	1.309	1.519	2.247	2.260	2.283	2.339
		1	5	"	.220	"	48400	.038013	"	129.1	1732	1940	2079	2797	3348	4550	6840	1.285	1.533	1.777	2.629	2.645	2.172	2.735
		1	6	"	.203	"	41209	.032365	"	109.9	1475	1652	1770	2387	2870	3885	5825	1.510	1.798	2.087	3.087	3.110	3.139	3.215
		1	7	"	.180	"	32400	.025447	"	86.42	1158	1296	1389	1894	2290	3083	4650	1.923	2.292	2.660	3.923	3.950	3.990	4.080
		1	8	"	.165	"	27225	.021382	"	72.61	975	1092	1170	1597	1934	2610	3940	2.280	2.720	3.165	4.680	4.710	4.670	4.870
		1	9	"	.148	"	21904	.017203	"	58.42	785	879	942	1305	1583	2137	3230	2.833	3.380	3.920	5.805	5.840	5.905	6.045
		1	10	"	.134	"	17956	.014103	"	47.89	645	722	774	1075	1319	1784	2690	3.453	4.112	4.790	7.090	7.140	7.205	7.370
1/8	.12500	1	11	"	.120	"	14400	.011310	"	38.41	515	577	618	895	1080	1465	2210	4.325	5.150	5.975	8.840	8.900	8.990	9.200
		1	12	"	.109	"	11881	.009331	"	31.69	425	476	510	756	905	1233	1857	5.235	6.240	7.250	10.700	10.77	10.88	11.25
		1	13	"	.095	"	9025	.007008	"	24.07	310	347	372	583	705	900	1437	7.180	8.550	9.930	14.250	14.35	14.49	14.83
		1	14	"	.083	"	6889	.005411	"	18.37	247	277	297	465	566	767	1147	9.000	10.72	12.43	18.470	18.59	18.77	19.20
		1	15	"	.072	"	5184	.004072	"	13.83	185	207	222	362	440	600	897	12.04	14.33	16.64	24.53	24.70	24.93	25.52
1/16	.06250	1	16	"	.065	"	4225	.003318	"	11.27	152	171	183	300	368	498	744	14.59	17.38	20.15	30.13	30.33	30.61	31.33
		1	17	"	.058	"	3364	.002642	"	8.972	120	135	145	244	302	407	608	18.50	22.00	25.60	37.80	38.03	38.40	39.35
		1	18	"	.049	"	2401	.001866	"	6.404	85	95	103	179	220	297	444	26.20	31.20	36.25	53.50	53.90	54.40	55.70
		1	19	"	.042	"	1764	.001385	"	4.705	63	71	76	136	169	227	338	35.30	42.00	48.80	72.10	72.55	73.30	75.00
		1	20	"	.035	"	1225	.0009621	"	3.267	44	49	53	98	120	163	241	50.80	60.50	70.33	103.7	104.4	105.5	108.0
1/32	.03125	1	21	"	.032	"	1024	.0008042	"	2.731	37	41	44	83	101	137	205	60.90	72.50	84.25	124.2	125.0	126.4	129.3
		1	22	"	.028	"	784	.0006158	"	2.091	28	31	34	65	79	106	158	79.50	94.70	109.9	162.1	163.4	165.0	168.8
1	1.00000	7	00	St.W.G.	.3310	.9930	.....	.086049	.602343	2080	27100	29800	32800	43200	52100	70550	106800	.0833	.0984	.1156	.1684	.1690	.1714	.1763
7/8	.87500	7	0	St.W.G.	.3065	.9195	.....	.073782	.516474	1780	23350	25700	28280	37100	44800	60725	91850	.0972	.1147	.1349	.1963	.1973	.1998	.2053
3/4	.75000	7	3	St.W.G.	.2437	.7311	.....	.046645	.326515	1126	14830	16630	17940	23600	28550	38700	58200	.1536	.1815	.2133	.3108	.3120	.3163	.3252
5/8	.62500	7	5	St.W.G.	.2070	.6210	.....	.033654	.235578	815	10770	12070	13200	17200	20780	28200	42300	.2129	.2518	.2958	.4310	.4330	.4385	.4510
9/16	.56250	7	6	St.W.G.	.1920	.5760	.....	.028953	.202671	700	9300	10420	11390	14900	18120	24330	36800	.2500	.2925	.3440	.5010	.5030	.5100	.5240
1/2	.50000	7	8	St.W.G.	.1620	.4860	.....	.020612	.144284	498	6245	7150	8240	10820	13100	176800	26640	.3480	.4110	.4830	.7030	.7070	.7165	.7300
7/16	.43750	7	9	St.W.G.	.1483	.4449	.....	.017273	.120911	418	5380	6020	7105	9160	111200	149900	226800	.4155	.4910	.5775	.8400	.8400	.8560	.8800
3/8	.37500	7	..	.....	.1250	.3750	.....	.012272	.085904	294	3860	4400	5063	6700	8120	11000	16625	.5845	.6900	.8120	1.180	1.187	1.203	1.237
5/16	.31250	7	12	St.W.G.	.1055	.3165	.....	.0087417	.061192	211	2828	3165	3681	4965	6000	8135	12220	.8090	.9555	1.123	1.635	1.642	1.666	1.710
9/32	.28125	7	10	B.& S.	.1019	.3057	.....	.0081553	.057087	195	2665	3022	3478	4675	5645	7685	11540	.8800	1.039	1.222	1.777	1.786	1.810	1.870
1/4	.25000	7	14	St.W.G.	.0800	.2400	.....	.0050266	.035186	121	1714	1934	2232	3045	3693	5020	7550	1.427	1.685	1.982	2.885	2.900	2.940	3.018
7/32	.21875	7	15	St.W.G.	.0720	.2160	.....	.0040715	.028501	98	1418	1574	1852	2515	3080	4185	6250	1.762	2.080	2.448	3.563	3.580	3.630	3.725
3/16	.18750	7	16	St.W.G.	.0625	.1875	.....	.0030680	.021476	74	1094	1223	1422	1957	2397	3270	4880	2.340	2.762	3.250	4.725	4.750	4.820	4.945
5/32	.15625	7	17	St.W.G.	.0540	.1620	.....	.0022902	.016031	55	835	923	1085	1507	1840	2510	3745	3.130	3.700	4.350	6.330	6.362	6.450	6.625
1/8	.12500	7	19	St.W.G.	.0410	.1230	.....	.0013203	.009242	32	499	554	647	913	1117	1524	2267	5.440	6.430	7.555	10.99	11.03	11.19	11.49
3/32	.09375	7	21	St.W.G.	.0317	.0951	.....	.00078924	.005247	19	289	326	378	537	661	895	1335	9.575	11.30	13.28	19.33	19.43	19.70	20.22
1	1.00000	19	5	St.W.G.	.2070	1.0350	.....	.033654	.639416	2218	29250	32800	35800	46600	56400	76500	114700	.0786	.0928	.1089	.1587	.1593	.1616	.1660
7/8	.87500	19	5	B.& S.G.	.18190	.9095	.....	.025987	.493753	1710	22750	24800	28120	36530	44450	59400	89850*	.1015	.1200	.1411	.2053	.2063	.2093	.2150
3/4	.75000	19	8	St.W.G.	.1620	.8100	.....	.020612	.391628	1357	18100	20250	22320	29370	35530	48000	72250	.1282	.1514	.1780	.2592	.2603	.2642	.2713
5/8	.62500	19	8	B.& S.G.	.1285	.6425	.....	.012969	.246411	855	11700	12870	14530	19200	23300	31450	47350	.2035	.2405	.2828	.4115	.4130	.4210	.4310
9/16	.56250	19	12	St.W.G.	.1055	.5275	.....	.0087417	.166092	575	8060	8850	10000	13590	16300	22100	33300	.3020	.3570	.4195	.6110	.6140	.6225	.6395
1/2	.50000	19	13	St.W.G.	.0915	.4575	.....	.0065755	.124935	433	6125	6815	7750	10500	12700	17300	259300	.4020	.4750	.5583	.8135	.8165	.8285	.8505
7/16	.43750	19	14	B.W.G.	.0830	.4150	.....	.0054106	.1028014	356	5150	5660	6480	8800	10750	14600	21800	.4883	.5770	.6785	.9870	.9920	1.005	1.032
3/8	.3750	19	15	St.W.G.	.0720	.3600	.....	.0040715	.0773584	268	3905	4310	5025	6825	8350	11350	16970	.6495	.7675	.9025	1.312	1.318	1.337	1.373
5/16	.31250	19	..	.....	.0600	.3000	.....	.0028274	.0537213	186	2765	3060	3600	4940	6075	8230	12240	.9340	1.102	1.297	1.888	1.897	1.922	1.975
9/32	.28125	19	17	B.W.G.	.0580	.2900	.....	.0026421	.0501999	174	2595	2873	2373	4625	5720	7750	11530	.9995	1.180	1.388	2.020	2.030	2.058	2.113
1/4	.2500	19	17	B.S.G.	.0453	.2265	.....	.0022902	.0306223	106	1591	1789	2142	2983	3675	4960	7400	1.638	1.936	2.278	3.315	3.330	3.378	3.470
1 1/4	1.25000	37	7	B.W.G.	.1800	1.2600	.....	.025447	.941539	3273	43300	47550	53600	69900	84700	113900	171500	.05330	.06300	.0740	.1077	.1082	.1097	.1128
1 1/8	1.12500	37	8	St.W.G.	.1620	1.1340	.....	.020612	.762644	2650	35250	39450	43500	57175	69250	93500	140700	.0659	.0779	.0915	.1330	.1337	.1355	.1389
1	1.00000	37	9	B.W.G.	.1483	1.0381	.....	.017273	.639101	2220	29850	33400	37530	48400	58750	79250	119700	.0786	.0929	1.090	1.588	1.594	1.618	1.661
1 1/2	1.50000	61	8	B.W.G.	.1650	1.485	.....	.021383	1.304363	4545	60750	66600	75100	98000	118000	159200	24050	.03845	.04550	.05340	.07780	.07820	.07930	.08140
1 3/8	1.37500	61	9	St.W.G.	.1483	1.3347	.....	.017273	1.053653	3670	49350	55125	62000	79900	97100	130900	197800	.04760	.05630	.06620	.09630	.09680	.09815	.1008

I.

Communicated to the writer by U. S. Bureau of Standards. Mean specific resistances of a number of samples actually measured by Bureau at 25° C.

Quality.	E.B.B.	B.B	Steel.	Siemens-Martin Steel.
Absohms, per cm. cube.....	10700	12200	13400	18300

Another test exhibits the following data:

Maker.	Size B.W.G.	Area, Cir. Mils.	Absohms at 68° F.	Lb. per sq. in. to break.
U	6	41200	13600	68800
U	9	22250	12400	76100
U	14	7100	11800	55400
V	6	40800	11800	68800
V	9	22000	10300	55800
V	14	6890	10600	50400
W	6	41210	10200	52200
W	9	22200	10300	49700
W	14	6720	10400	44700
X	6	42020	10200	55900
X	9	21900	10700	52300
X	14	6725	10500	50400
Y	6	41500	10500	60500
Y	9	22200	11400	52300

The above appear in Fig. 12 in target form as circles. In the same figure are also plotted as heavy dots data supplied by The American Steel & Wire Company, while the triangular points appear in Roebling's handbook. Boxed points are for German wires at 15° C., manufactured by Felton & Guilleaume Carlswerk, while the double boxed point is connected with Fig. 8.

II.

A. S. & W. Co..... 4	56500	10690	E.B.B.
A. S. & W. Co..... 8	27100	10560	E.B.B.
A. S. & W. Co 10	17790	10820	E.B.B.
A. S. & W. Co..... 5	50000	13530	Steel
A. S. & W. Co..... 8	26800	13130	Steel
A. S. & W. Co.....10	17956	13390	Steel

Other examples are given in Figs. 7, 8, 9 and 10.

(To be continued.)

SAN FRANCISCO BOY WINS POSTER CONTEST FOR AMERICA'S ELECTRICAL WEEK

The winning poster might well be entitled "Aladdin; Symbol of Service."

The Modern Aladdin and the Electric Button.

This design will be used throughout the campaign, millions of poster stamps, window and car cards, lithographs, bill posters, in newspapers, magazines, etc. It will be reproduced at least 200,000,000 times. Harold von Schmidt, a San Francisco boy, is the winner of the contest.

A MAMMOTH ELECTRIC BAKE OVEN.

BY BAYARD W. MENDENHALL.

So far as is known the first brand of bread to be put on the market which will be extensively advertised as being baked electrically has made its appearance in Salt Lake City. The New Vienna Baking Company of that city announced this new product during the week of August 7th to 12th while the convention of the National Association of Master Bakers was in session in that city. "Butter Krust," the trade name adopted, is baked exclusively in a mammoth Hughes

The Largest Electric Bake Oven in Existence.

electric bake oven installed by this progressive baking company. This company does an exclusive wholesale business, their entire product being sold through retail dealers.

The announcement made by Mr. Martinov, manager of the baking company, during the convention, will do much to stimulate interest in electric bake ovens all over the United States. A full page advertisement in the Salt Lake City newspapers while the Bakers' Convention was in session attracted much attention and practically every baker in attendance at one time or another visited this new installation. Mr. Martinov has a thoroughly modern bakery throughout including individually motor driven mixers, dividers, rounders and electrically heated wrapping and sealing machines. While his "Butter-Krust" bread was first announced during the convention week it sprang into instant popularity.

This Hughes oven is the largest electric oven yet installed and is their standard No. 415. The main body of the oven is 4 ft. high, 10 ft. wide and 12 ft. deep. It rests on an angle iron frame 27 in. high. It is divided into four chambers, each 56 in. by 34 in. by 16 in. high, which provides a baking surface of 208 square ft. The oven has a capacity of 836 twelve ounce loaves or 456 twenty-five ounce loaves of bread. The oven is divided in the center by a partition with two baking compartments on each side, one above the other. All compartments have 1¾ in. tile floor. The customary steam connection is provided for each. Each half of the oven has three heating units. One in the top of the upper compartment; one in the top of the lower compartment; and one directly under the floor of the bottom compartment. With this arrangement, heat

is provided for the top and bottom of each baking chamber. Each compartment has a mercury thermometer and inside lights.

The heating units are made up of resistance wire wound on insulated rods. These rods are mounted in an angle iron frame which may be slipped in and out of the oven for inspection and repairs. Each unit is divided into three sections, and each section has three heats controlled by three heat switches which are located near the center of the oven in front and within easy reach of the operator. This arrangement gives great flexibility and enables the baker to produce a uniform temperature throughout the entire baking surface of the oven. The doors through which the oven is filled are of the balanced type and are easily opened by the baker with the oven peel.

Galvanized iron is used for the outer cover of the oven with a white enamel front. The inside of the wall is of black iron covered with rust resisting black enamel.

The oven is wired to receive 220-volt 2-phase service. It has a maximum demand of 75 kilowatts and averages 48 per cent of its maximum demand on sixteen hours' baking per day and 55 per cent on eight hours' baking per day. It requires forty-five minutes to load the oven, bake the bread and take it out, using three-quarter pound loaves. On this schedule 25,000 three-quarter pound loaves could be baked in twenty-four hours continuous baking.

The product is admitted by all bakers to be superior to that produced by the old style ovens.

One great advantage of the electric heat lies in the fact that it is possible to maintain practically a uniform temperature in the oven through the entire period of baking, while with the brick oven the temperature gradually reduces and the time for baking is extended making it difficult to produce a uniform product.

A talk with the manager and head baker brings out the fact that they are very enthusiastic over electric baking. While they state that the bare cost for electricity is some higher than the cost of coal that when one considers the many advantages of the electric oven, not the least of which is the entire absence of dirt, dust, and smoke which inevitably go with the old brick oven and the saving in space, the higher cost for fuel is more than offset. While it is a little too early to say it definitely, it is believed by them that the value of the "baked electrically" feature of their product for advertising purposes will also go far to offset the somewhat increased cost of operation.

The oven is manufactured by the Hughes Electric Heating Company of Chicago. It was sold for the Utah Power & LightCompany by Mr. George W. Cole, special salesman, assisted by H. P. Munger, western sales manager of the Hughes Company. The installation was made under the direction of Harry McClelland, one of the Hughes bake oven specialists, formerly with the Utah Power & Light Company.

The advertising campaign bringing out this new product was conducted for the Vienna Baking Company by Mr. R. J. Nafe of the Schulze Advertising Service of Chicago. Mr. Nafe succeeded in getting the various companies interested in the success of this new product to co-operate in two full paged advertisements in the newspapers announcing its inauguration.

MODERN APPLICATIONS OF ELECTRICITY TO MEDICINE.

BY DONALD K. LIPPINCOTT.

(Description and discussion is herein given regarding methods of obtaining high frequency current for x-ray tubes as well as current for fulgeration and other approved electro-medical practices. The author is associated with the Rieber Laboratories at San Francisco.—The Editor.)

To the average electrical man the term medical electricity probably brings vague recollections of electric belt advertisements. It is for him and not for the specialist that this review of the modern uses of electricity in medicine is written.

The ever widening field of the x-ray makes this the most important application of electricity to medicine. Used at first for the obvious purpose of localizing fractures, modern technique has made it available for diagnosing lesions of the stomach, intestines, kidneys, lungs and brain, while modern dentistry would be almost helpless without it.

There are four types of apparatus used for supplying the high tension current necessary for exciting x-ray tubes. The static machine was the first of these to be developed. Its advantages were that it gave a high potential, uniform current, and was therefore, "easy on tubes." Machines were made with twenty-four or more plates, 2 to 4 ft. in diameter, and were driven by hand or by belt from a motor. A few are still to be found in some of the older offices, but their low efficiency, high cost, the small total power available from even the largest sizes, and their maddening habit of refusing to work on damp days have made them practically obsolete.

Almost simultaneously with the static machine the induction coil was developed for this work, and for many years has been the favorite with the greater number of Roentgenologists. The ordinary type uses 110 or 220 volt d.c. on the primary side, with an input of 1 to 2 kw. Where direct current is not available a chemical rectifier is often used, or else power is taken from a small motor-generator set.

A mercury turbine interrupter, motor driven, with a rotating mercury jet playing on alternate conducting and insulating segments, is used in some outfits to break the current, while an electrolytic interrupter is supplied with others. But mercury, covered with kerosene to keep it from oxidizing, will emulsify and refuse to carry current, and electrolytic interrupters will sulk if too much platinum point is exposed, or too little, if the electrolyte is of the wrong density, or for no known reason, so the wise doctor usually had both types with a selector switch—and no sane man would guarantee him against trouble even then.

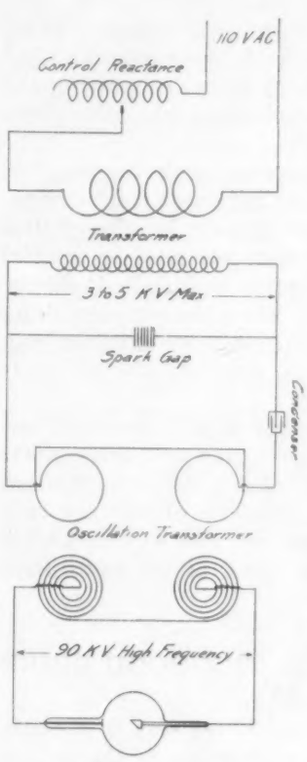
Control of tube voltage and current, mutually interdependent in this type of apparatus, is given by a multipoint rheostat, and, in some cases, by varying the number of primary turns on the coil.

Such an apparatus will give a secondary voltage of from 70 to 120 kilovolts maximum, and may supply as high as 30 milliamperes through the tube, though 15 milliamperes is a more usual figure. The lower voltage supplied on the "make" than the "break" of the primary circuit is relied upon to prevent "inverse," as current passing through the tube in the wrong direction is called. On account of the initial break-

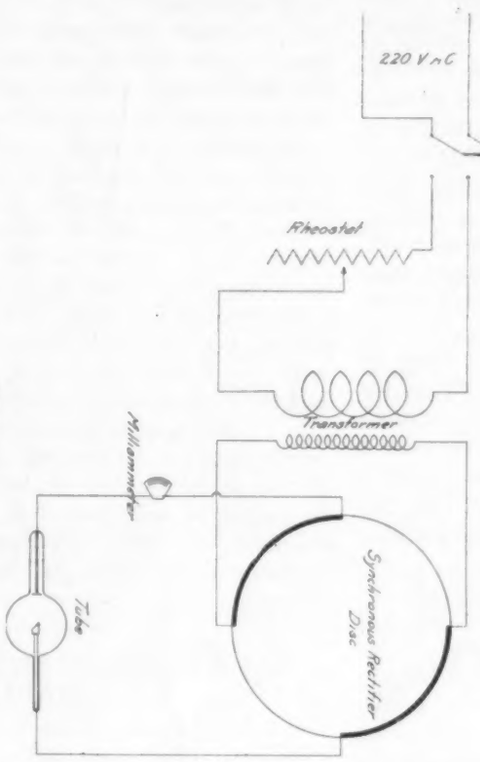
down voltage of the tube—from 10 to 30 kilovolts—this is usually effective, but sometimes other devices are necessary, in which case series spark gaps or valve tubes are used.

Where no great power is necessary, a coil will give good service, but for lung or stomach pictures, where involuntary movements will cause blurring unless the picture is practically instantaneous, the only type of apparatus which will give results is the so called "interrupterless transformer." Although there are many of these on the market, and although they vary greatly as to results obtainable, they differ little in the essentials.

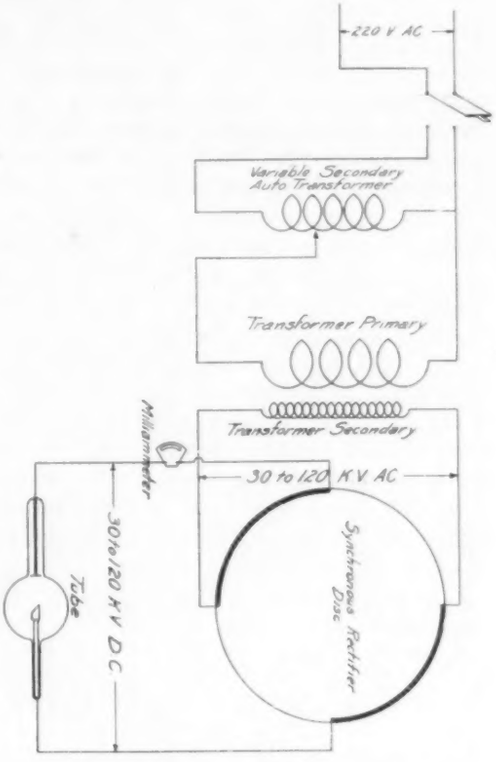
the penetration of the rays depends entirely upon the tube voltage. With impedance control of voltage, which is furnished with the great majority of the apparatus on the market, consistent results can be obtained only as long as the tube resistance remains constant, and fairly high. When the tube warms up with use and demands a larger current, the impedance drop across the apparatus consumes a greater proportion of the total voltage, until the part backed up by the tube may become so small that the rays will not even penetrate flesh, and the shadow of a hand on the photographic plate will show a uniform density and fail to reveal the bones at all.



High Frequency X-Ray Generator.



High Impedance Control Interruptless Transformer.



Low Impedance Control Interruptless Transformer.

Power is drawn from a.c. mains to supply a transformer, which would be rated by the A. I. E. E. at from 3 to 15 k.v.a., and for which the makers proudly claim from 5 to 25 k.v.a. output. A commutating switch, driven from the same mains by a synchronous motor, rectifies the high tension secondary current, supplying a pulsating uni-directional current to the tube.

Most makers claim from 150 to 200 kilovolts as their maximum secondary voltage. The results of a large number of sphere gap tests of different makes have failed to show over 90 kilovolts, although the flash over voltage of the rectifier, and not the transformer maximum, has usually proved to be the limiting factor.

The best outfits vary their voltage by an autotransformer, in the low tension side, with multiple taps. With this arrangement, the tube voltage regulation from zero to full load—which may be as high as three hundred milliamperes with this type of apparatus—is very good. This is an important point, as

The same considerations show why the doctor demands leads much heavier than his total load would seem to warrant. To him voltage regulation is all important, and line drop must be reduced to a minimum.

The high frequency type of x-ray generator is used principally in portable apparatus. A small transformer giving a secondary voltage of about 3000 supplies an oscillating circuit which includes the primary of an oscillation transformer, which steps the voltage up to about 90 kilovolts. With this apparatus, a special form of tube is used, which shields the plate from rays generated by inverse current. These tubes also have certain valve tube characteristics, in that they show a lower resistance to direct than to inverse current.

Regulation is obtained by a reactance in the transformer circuit and by varying the spark gap in the oscillating circuit.

The big points in favor of this apparatus are its lightness and cheapness. A complete outfit, including tube, will weigh only from 60 to 75 lb. and cost less than $200; hence the popularity of this type of device

with the general practitioner, 90 per cent of whose x-ray work it will handle. For anyone making a specialty of Roentgenology, however, the low power available makes it useless.

All of the types of apparatus mentioned are used for giving treatment for various diseases, as well as for taking pictures. Owing to the danger of serious results from over-exposure to the rays only the "interrupterless" type should be used, as with this type alone can the exposure be so metered as to make accurate results possible.

Leaving the x-ray and taking up the other uses of the electric current, the most important application is the surgical use of the high frequency spark in "fulgeration" or "dessication" as it is called.

At very high frequencies—500,000 per second or over—a current of over an ampere (.25 ampere will cause death at low frequencies), may be passed through the body without producing muscular constraction or any sensation other than one of warmth. This makes it possible to burn out tumors by sparking to them directly, using the body of the patient as a ground or return circuit. A wide range of ailments, from warts to inoperable cancer, are treated in this manner, non-malignant tumors of the bladder being the field where it has found especial usefulness.

The apparatus used is substantially the same as that used for generating high frequency current for x-ray use. The voltage required is much lower, however (10,000 volts maximum), and the circuits should be designed to give a much greater frequency than is usual for x-ray work. It is also important that the spark gap give a very steady discharge, as inequalities produce painful muscular contractions.

High frequency currents themselves are recommended for everything from diabetes to baldness, but the general opinion of the medical profession seems to be that such results as they may show are largely due to the psychological effect. Applied to the entire system they will produce a temporary reduction in blood pressure, which is sometimes desirable, but a Turkish bath will produce as lasting an effect more surely.

Direct current at a potential of from eight to one hundred volts is used for various purposes. As variations in the voltage may be very painful, dry or storage batteries are often used as the source of current. Another type of apparatus in general use taps off at different points along a resistance supplied by a 110 volt d.c. circuit. The current used is from three to fifteen milliamperes. The chief use of this "galvanic" current is in the removal of moles, warts or superfluous hair by electrolysis.

Slow sinusoidal current, at voltage up to about 100, are used for exercising atrophied or partially paralized muscles. They are produced by belt connected motor generator sets. The frequencies used are from one to fifteen per second, depending on the part of the body involved.

Even the "electro medical battery coil"—advertised in all mail order catalogs, and very similar to the one with which you shocked your admiring relatives when first you dabbled in electricity, has some use. In diagnosing certain diseases of the nervous system, it is invaluable—the principle being that if one doesn't kick when jolted with it there is something very wrong. It is also used in the same manner as the sinusodial generator.

In an article of this kind it is impossible to give all of the types of apparatus in use, or to more than touch upon a few of the uses of the types mentioned. Enough has been said to give some idea of the large medical field in which electricity finds rational employment—a field that is widening every day. The psychological factor, too, should not be underestimated. Medical application of electricity in any form is bound to impress upon the patient that something is being done for him. The treatment is harmless, and "faith cure" often works.

Of course there are, and probably always will be, quacks who operate in this field "for revenue only," but that should not prevent us from recognizing the earnest, scientific work of the pioneers who have given it its present standing.

No electro medical apparatus, with the possible exception of x-ray outfits of the induction coil or transformer classes, should make trouble for the central station man. Either of these types may be fruitful sources of surges and should never be installed without some form of line protection. Here the simplest thing seems to be the best. A high resistance graphite rod, with the middle grounded, is not only the cheapest but the most effective remedy.

Prophecy as to development of new electro-therapeutic uses can be nothing more than wild guesswork. Future x-ray progress is more clearly defined. Modern tubes are at best less than one-fifth of one per cent efficient. To bring this figure up, and to standardize equipment and units, is the work of the immediate future.

A HOME ELECTRICAL IN THE HOOD RIVER VALLEY.

R. E. Fewell, of the Hood River Gas & Electric Company, next week will complete one of the unique homes in Oregon. His new residence, an eight-room bungalow, is chimneyless. Mr. Fewell is a skilled electrician, and in every room he is installing electric radiators. Beneath the house, to furnish hot air to circulate between the double floors, will be a large electric furnace. The kitchen range will be an electric one. Electric motors will operate washing and ironing machines.

CALIFORNIA HEADS LIST IN PETROLEUM.

The quantity of petroleum marketed in the United States during the first half year of 1916 is estimated by John D. Northrop of the United States Geological Survey at 140,000,000 bbls. His estimate is moderate and his apportionment of the output among the major fields is as follows: Appalachian, 11,400,000 barrels; Lima-India, 1,800,000; Illinois, 7,900,000; Kansas and Oklahoma, 50,500,000; Northern and Central Texas, 4,200,000; Northwest Louisiana, 6,800,000; Gulf Coast, 11,400,000; Wyoming and Montana, 2,400,000; California, 43,500,000; miscellaneous (Colorado, Michigan, Missouri), 100,000; total, 140,000,000.

SPARKS—CURRENT FACTS, FIGURES AND FANCY

The winning cover poster for America's Electrical Week is to be reproduced over 200,000,000 times during the big electrical campaign this fall. Even the ten million cannon shells fired at Verdun are not in the same class as this concentrated volley.

* * *

Gophers on the Klamath project, according to the June Reclamation Record, refused to eat the usual grain poisons, an effective method of killing them however was devised by the use of the exhaust fumes from automobiles. A rubber hose was attached to the exhaust pipe, the other end being placed in the gopher hole, earth being pressed around it to retain the fumes in the hole. This method was succesful, and where the gopher holes were thick a large number could be treated in a short time.

* * *

The Council of the Institution of Electrical Engineers of Great Britain has adopted resolutions stating several measures which it advocates as a means of advancement for British engineering. It is in favor of a broader recognition of high technical attainments, and among the changes it advocates is that the use of the metric system be made compulsory after a reasonable period, and that during this period all trade catalogues makes use of both the British and metric systems.

* * *

The value of manufactured products in the United States was $24,246,323,000 in 1914, and $20,672,052,000 in 1909, the increase being $3,574,271,000, or 17.3 per cent, according to figures compiled by the U. S. Bureau of Census.

* * *

The aggregate of the tolls collected from the ships passing through the Panama Canal during the past year is $2,399,830.42, nearly eight hundred ocean going vessels having passed through. Due to the closure of the canal for six months the above represents about sixth months' business for the normal year.

* * *

The sundry civil act, approved July 1, 1916, appropriated $80,000 for establishing a light and fog-signal station at Point Vicente, Cal. Point Vicente is the most prominent point on the California coast between Point Loma and Point Conception, a distance of 220 nautical miles. This light will serve the increased traffic due to the opening of the Panama Canal.

* * *

The Japanese government is fostering a scheme for small life insurance policies, the maximum amount of insurance on a person being one hundred twenty four dollars. No physical examination of the applicant is to be made, but if the insured dies within two years from the date of the insurance contract, from a cause other than "a natural calamity, or a contagious disease, such as cholera, smallpox, dysentery, typhoid fever, typhus fever, scarlet fever, diphtheria, or plague," a portion of the amount insured may not be paid.

* * *

British efforts to increase trade with Russia after the war are taking the extremely practical shape of encouraging the study of the Russian language by young men training for commercial life. We of the Pacific Coast should follow this example and urge our young men to perfect themselves in Spanish.

* * *

The crude petroleum marketed in the United States in 1915 amounted to 281,104,104 barrels, valued at $179,462,890, thus breaking all previous records.

* * *

The average price received at the well for crude petroleum during 1915 was 64 cents a barrel.

* * *

The gas industry has adopted the word "gastrone," meaning a lady who operates a gas range with such artistry that she satisfies the tastes of the gastronomer, or the epicurean fond of good living.

* * *

What shall we call the lady who operates the modern electric range? An electrone, trone or drone? If by the last word we mean a "do-nothing" and yet "one who takes the honey," surely the operator of an electric range meets the requirements.

* * *

Did you ever stop to think that if the twenty million American families install electric ranges a sales campaign of a billion dollars will have been put over in this one branch of possible electric appliance installations?

* * *

And did you ever stop to think that such an installation would increase the central station power load by about three hundred millions of dollars a year?

* * *

The greatest telescope in the world, a 100-inch reflector, is soon to be completed upon Mt. Lowe in Southern California. Maybe we will yet see something live and interesting on Mars, who knows?

* * *

America's Electrical Week, December 2 to 9, will surpass all previous attempts. When you see a copy of the "Electrifier," and the "Exciter" soon to appear, you will at once double your former enthusiastic support.

* * *

Bolivia in South America is as big as Germany, Austria and England. Peru is as large as all the United States from Nova Scotia to Indiana, from Canada south to the gulf. Argentina equals all the United States west of Omaha. And Brazil is a United States with another Texas added.

JOURNAL OF ELECTRICITY
POWER AND GAS

FOUNDED 1887

PUBLISHED WEEKLY BY THE

Technical Publishing Company

Crossley Building, San Francisco

ON LIBRARY CARS OF ALL SOUTHERN PACIFIC TRAINS

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico	per year,	$2.50
Dominion of Canada	" "	3.50
Other Foreign Countries within the Postal Union	" "	5.00
Single Copies, Current Month	each,	.25

NOTICE TO ADVERTISERS.

Change of advertising copy should reach this office ten days in advance of date of issue. New advertisements will be accepted up to noon Monday dated Saturday of the same week. Where proof is to be returned for approval, Eastern advertisers should mail copy at least thirty days in advance of date of issue.

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The Dual Use of Water

California has often set the precedent for the establishment of mining and water right customs throughout the various Western commonwealths. The latest precedent that has now been established is that relating to the dual use of water.

As is generally known stored waters may be put to three or more separate and distinct uses. For instance, the water may be used for power development and later used in the irrigation of arid lands or for domestic purposes of a municipality. As to whether a company derives the right to all three of these uses by simply developing the power, for instance, has long been a debatable question.

On another page of this issue may be found an interesting and important discussion of various phases of this problem by the California Water Commission. Undoubtedly all the rights that may accrue from stored waters should belong to the company or corporation that foots the bill for development, provided of course the water is put to a beneficial use and reasonable rates are granted for water purchasers on the part of others in which the district is located.

In the past the greatest injustice has come about in the dual uses of water from old mill rights that were established in the early days and later on abandoned.

In Montana, for instance on many streams mill rights were taken out and upon abandonment of the mill operations, the locators claimed this water for irrigation purposes of date of their original filing. Meanwhile agricultural interests began to flourish in various communities and appropriators for irrigation found themselves confronted with mill rights that had only been used as such in the early days, but subsequent to their appropriations the owners of the mill rights had attempted to divert the waters upon arid lands in the community and make their appropriations tally in date with that of the original filing.

Such practices as this wreaked much injustice upon legitimate settlers who had in a bona fide manner located upon their lands only later to find themselves confronted with costly litigation.

It would seem that immediate and positive rulings should be sought for and established at an early date throughout all our Western communities. And in cases where the law is not sufficient to properly make an adjudication, those interested in the stability of Western water rights should see to it that the proper laws are passed.

True Preparedness

Now that the enthusiasm of preparedness parades has somewhat spent itself, it would seem right and proper to quietly analyze just for what purpose a gigantic preparedness propaganda has been undertaken throughout the nation from shore to shore.

The question in its ultimate analysis will be seen to be fundamentally not one merely of patriotic fervor alone, but one that has at its foundation a reason which closely calls into question the ethical standard that this nation in its foreign commercial and engi-

neering activity may have had or may have in the future. Thus at once we are interested from the very nature of the question.

Let each ask himself the question "why prepare?" and the answer comes back that some nation may take the American nation unawares and enslave it commercially or otherwise. But why should some nation desire to do this? Because fundamentally it may bear a grievance against America.

Let us then see just what grievances foreign nations may bear against this country and apply the remedy. Although such a procedure may not safeguard America against predatory nations, yet in the course of international righteousness, such a course on our part would bring about true preparedness—a preparedness that adjusts grievances ahead of time on the principle that "a stitch in time saves nine."

When one travels through the far off Orient or to South American ports he is often caused to blush when there is related to him some act of questionable business practice that the socalled "yankee trader" has inflicted and is still inflicting in countless places among our foreign neighbors.

It is needless to list the case of antiquated agricultural implements shoveled off upon the unsuspecting Argentino, or the inferior grade of machinery that has at times been unloaded upon the ignorant Chinese.

The question before us is that these abuses have been committed, one hears it on all sides in foreign ports.

It would seem, then, a splendid "true preparedness" measure on the part of the American government to appropriate a million or two along with the millions for guns and cannons now under way for the sole purpose of seeing to it through a Foreign Relations Commission that fair play is given our neighbors in every respect and that the good name of America be not besmirched by close-fisted, questionable practice on the part of a certain class of Americans dealing with our foreign neighbors.

Advertising Arguments for the Dealer

Fully half of the electrical dealers' difficulty is due to his not knowing how to advertise. Limited demand, slow turnover, high overhead, department store competition—the things that keep him awake nights—can all be met by the right kind of advertising.

Consider the problem of increasing the demand, to make prospective purchasers realize the disadvantage of trying to get along without electricity. This means the finding of new publics, the creation of business where none existed before. Here is advertising's first function, to eliminate limitation of demand by extending the sales field.

Weigh in mind the trouble caused by infrequent turnover, which is only another name for insufficient capital. Money tied up in a slowly moving stock is manifestly not available for carrying on other activities. In any retail business goods that do not turn over at least four times a year are parasites. Advertising is a wonderful acceleration of frequency and turnover.

How to induce the overhead per unit sale is another problem solved by advertising. This overhead is largely caused by the high cost of selling, of distributing articles to the ultimate consumer. Advertising, universally acknowledged as the most economical method of distribution, is a potent factor in cutting the cost of selling.

Department store competition is an ever-present bug-a-boo to the electric specialty shop. The success of the modern department store is dependent upon its advertising. In fighting fire with fire, in emphasizing the value of expert service, lies the only recourse left to the electric shop. Let the small store's trade-mark center in service, in greater personal contact with the customer and its ultimate success is assured.

Advertising should not be confused with personal salesmanship. By bringing buyers to the store it allows the counter-salesman to close the sale. Using salesmen as advertisers is as wasteful as using an advertisement as a salesman. One supplements the other. Advertising repetition establishes a reputation for a commodity or a service. Salesmanship cashes in on that reputation.

Let the retailer remember that the same arguments that induced him to buy his goods will usually sell them to his customers, especially if his advertising sales arguments are charged with vitality and enthusiasm. Every advertisement should carry something of real news interest, an easy requirement with electricity today.

A good advertisement should appeal to the people to whom it is directed. It should be timely and pertinent. When written naturally so as to carry the individuality of the advertiser and when so specific as not to apply to any other advertiser it is most effective, especially when it gives an impression of authority and sincerity. If carried on consistently and persistently it cannot fail in its purpose of instilling confidence.

By this is meant not only newspaper advertising but also window displays, store cards, demonstrations, bill-boards, street car cards and mailed literature. In all these respects the dealers' helps supplied by manufacturers and jobbers are valuable if they do not subordinate the individuality of the dealer in emphasizing the product. Such material should tie in the store with the manufacturer's publicity, should emphasize the dealer's facilities and buying judgment and should lay stress on the superior service rendered by a specialty shop.

These suggestions require courage and capital, without both of which no man should embark as an electrical retailer. Bigger profits come only from bigger advertising, better salespeople, improved service and superior stock—none of which can be obtained by cutting down expenses in a futile attempt to get around the cause of diminishing returns. Thus, and thus only, will it be possible to speedily convert today's electrical luxury into tomorrow's electrical necessity.

PERSONALS

W. Brewster Hall, Pacific Coast manager Pass & Seymour, Inc., left for Solvay, N. Y., this week.

W. E. Eskew, manager Electra plant, Pacific Gas & Electric Company, was at San Francisco this week.

Walter G. Clark, consulting engineer of New York City, was at San Francisco during the first week in August.

H. R. Noack, Pierson, Roeding & Company, San Francisco, has returned from a vacation trip in the high Sierras.

T. H. Nelms, salesman, Pacific States Electric Company is making an extended trip through Northern California.

A. F. Holmes, purchasing agent Electric Appliance Company, is expected to return to San Francisco from Chicago this week.

Robert Tchumay, proprietor Visalia Electric Works, has returned to Visalia from an auto trip to the San Francisco bay region.

J. B. Bell, Pacific Coast manager of the Standard Underground Cable Company, has returned to San Francisco from Los Angeles.

Frank Somers, president California Association of Electrical Contractors and Dealers, was at San Francisco from San Jose this week.

W. W. Briggs, general sales agent Great Western Power Company, has returned to San Francisco from a two weeks' outing in Sonoma County.

C. R. Downs, manager of the Amador Electric Light & Power Company of Sutter Creek, Cal., was at San Francisco during the past week.

M. S. Orrick, Western Electric Company, has returned to San Francisco from a two weeks' automobile trip over the Tioga Road to Lake Tahoe.

G. B. Rosenblatt, engineer in charge mining division Westinghouse Electric & Manufacturing Company, has returned to Salt Lake City from California.

W. L. Goodwin, vice-president Pacific States Electric Company, is making an automobile trip through Yosemite and Lake Tahoe over the Tioga road.

S. J. Lisberger, superintendent of distribution for the Pacific Gas & Electric Company, has returned to San Francisco from his vacation at Lake Tahoe.

H. S. Batchelder, formerly in the electric sign business, has joined the Western States Gas & Electric Company at Stockton, Cal., as commercial manager.

Edgar A. Loew, who has been assistant professor of electrical engineering at the University of Washington, Seattle, has been promoted to an associate professorship.

Henry L. Doherty, president of Henry L. Doherty & Co., and president of the Society for Electrical Development, is a candidate for election as Jupiter of the Jovian Order at the annual congress at Indianapolis, October 18, 19 and 20.

James F. Kinder, western representative of the Wise-Harrold Electric Company, of Canton, Ohio, manufacturers of the well known Ohio Vacuum Cleaner, visited San Francisco this week; making a trip over the entire territory on his way north.

Wm. Tardiff, salesman Electric Appliance Company, has returned to San Francisco from a two weeks' vacation in Lake County, California. **Frank Mills** of the company is renewing old acquaintances with the California-Oregon Power Company in Shasta County.

Frederick Bedell, professor of applied electricity at Cornell University, is at San Francisco, whence he will proceed to Seattle to attend the Pacific Coast convention of the American Institute of Electircal Engineers, where he is to present a paper on "Characteristics of Admittance Type of Wave Form Standards."

Tracy E. Bibbins, newly-elected president of the Pacific States Electric Company, has long been regarded as the dean of electrical supply men in the West. Ever since 1890, when he cut his eye-teeth as general factotum in a little supply house at Portland, he has been actively identified with every movement tending towards the betterment of the electrical supply business. During the early nineties he was storekeeper for the Edison General Electric Company at Portland, a consolidation of the Edison Manufacturing Company and other of the Edison companies which in turn took in the Northwest Electric Supply & Construction Company,

Tracy E. Bibbins, Newly Elected President of the Pacific States Electric Company.

of which S. Z. Mitchell, now president of the Electric Bond & Share Company, was then the head. With the amalgamation of the Thomson-Houston and oher companies forming the General Electric Company, Mr. Bibbins came to San Francisco in 1895 as a clerk in the supply department under F. M. Ray. He was made supply manager when Mr. Ray resigned in 1901. At this time he was associated with others in starting the original electrical jobbers' organization which subsequently developed into the Pacific Coast Electrical Supply Jobbers' Association. In 1912 Mr. Bibbins was made local manager of the General Electric Company, which position he has filled to date. Those who have watched Mr. Bibbins' past activities cannot but conclude that in taking the helm for the Pacific States Electric Company he will make no change in the company's established policy of assisting in the upbuilding of the electrical business in the West by active sales and educational effort. His wide experience in the supply business and his proven ability as an organizer should be the means of greatly strengthening the jobbing interests on the Coast. Incidentally he is again a strong candidate for the old copper cup which has long been the supreme trophy contested for at the quarterly golf games played by the jobbers.

R. A. Lundquist, consulting engineer of Minneapolis, has been selected by the Bureau of Foreign and Domestic Commerce, Department of Commerce, to study the markets for electrical goods in China, India, Australia, South Africa and a number of other countries in the Far East. There was a time when American electrical goods met with considerable competition in the Far East, but the war has greatly hapdicapped the principal European competitors, and American manufacturers are making a serious effort to take advantage of the situation and get permanent possession of the markets. A great deal of preliminary study is still needed, and Special Agent Lundquist's part in the campaign will be to ascertain the types, qualities and costs, of electrcal apparatus with which American goods come into competition, as well as to look into the general opportunities for the sale of such goods. Before leaving on the trip the special agent will spend some weeks in the principal business and manufacturing centers conferring with manufacturers, exporters, and business houses on the scope of the investigation. Mr. Lundquist was graduated from the University of Minnesota in 1905 with the degree of Electrical Engineer, following which he put in six years with prominent electrical houses. Since 1911 he has been in business for himself in Minneapolis, specializing in hydroelectric and transmission-line work. He is the author of "Transmission Line Construction—Methods and Costs," and has contributed numerous articles to the technical press.

NOTES OF CALIFORNIA WATER COMMISSION.

The Walker Mining Company of Salt Lake City, has applied to the commission for permission to appropriate 20 cubic feet per second of the waters of Ward and Nye Creeks in Plumas county for power purposes, used in mining and milling. The sources of diversion are tributaries of the Feather River. The total fall to be utilized is 514.4 ft. and the amount of power to be developed is 1165 theoretical horsepower by means of two Pelton wheels. The water is to be returned to Ward Creek after use.

The California Farm & Irrigation Company of San Francisco, has applied to the commission for permission to appropriate 375 cubic feet per second of the waters of the Colorado River in Riverside county. The application sets forth that by a pipe line and tunnel six miles long the water is to be conveyed to 60,000 acres, the works to be known as the Palo Verde Irrigation Canal. The water is to be diverted from the river by pumping plants and the estimated cost of the project is given as $2,300 000. The details of the proposition are as yet incomplete.

SUSTAINING NIAGARA'S BEAUTIES THROUGH THE NIGHT—ELECTRICALLY.

To gaze upon the tumbling, seething waters of Niagara Falls is to gaze upon America's most beautiful work of Nature. A pity it has been that the coming of night shut out from the visitor's eyes the beauties and wonders of the falling waters that only the day disclose. Many the visitor who forebore a stop-over at the Falls because his train stopped at Niagara after the sun went down. Partly through altruistic motives and partly because of business and advertising the city of Niagara Falls, New York, appointed a committee to suggest a plan of flood lighting this city's prime attraction.

As a result of this demonstration and because of the extreme simplicity and low upkeep of the light, the contract for flood lighting the Falls was awarded to the Western Electric Company. The flood lighting unit that will be used is a standard light that the Western Electric Company has installed throughout the country to flood light bathing beaches, large indusrial plants, railroad yards and for every use where light at night is essential.

NEW BULLETINS AND CATALOGUES

"Constants of Spectral Radiation of a Uniformly Heated Inclosure or So-called Black Body, II," is the subject of Scientific Paper No. 284 of the Bureau of Standards. The analysis of energy from a uniformly heated inclosure involves the determination of the amount of energy at various wave lengths in the spectrum. The present paper gives a precise re-computation of constants involved.

A new publication of the Bureau of Standards (Scientific Paper No. 283) entitled "Volume Effect in the Silver Voltameter," is ready for distribution. This paper is a continuation of the Bureau's researches on the Silver Voltamete which is the primary standard for the measurement of the International Ampere. It has been found that when the electrolyte for the voltameter is not sufficiently pure that the deposits in the large voltameters are in excess of those in the small voltameters in series with them.

The Bureau of Standards (Scientific Paper No. 281) entitled "A Study of the Inductance of Four-Terminal Resistance Standards," has made its appearance. This paper deals with the inductance of electrical resistance of less than one ohm. New methods of measuring alternate current require small resistances in the laboratory tests. Even very small errors in a standard would introduce serious errors in resulting measurements. This represents an important and practical contribution to precision measurements.

Bureau of Mines Technical Paper 145, just issued, is entitled Sensitiveness to Detonation of Trinitrotoinene and Tetranitromethy Canilin.

Technical Paper 161 of the Bureau of Mines, just issued, is entitled The Construction and Operation of a Single-tube Cracking Furnace for Making Gasoline, and deals with the general principles involved in the cracking of oils and distillate by the Rittman process.

"How to Build Up Furnace Efficiency" is the title of a book let just issued by Jos. W. Hays, combustion engineeer.

This little book treats in an interesting and efficient manner the subject matter suggested in the title under five headings: "Why your fuel is wasted," "How your fuel is wasted," "How to 'spot' your fuel wastes," "How to stop your fuel wastes" and "How to keep the wastes stopped." The book is written in a free, open, popular style void of high sounding technical terms and theory. Its purpose is to show "why," "how," and "where" fuel is wasted in the boiler room and to prescribe the remedy. While the major portion of the text deals largely with coal consuming plants, still an appendix has been added on fuel oil burning that will be of much practical assistance to Pacific Coast central stations using crude oil as fuel. The book should be in the hands of every up-to-date fireman and central station operator. The author is a combustion engineer and has written several other practical works on combustion.

TRADE NOTES.

The Electrical Contractors' and Dealers' Association of San Francisco have passed a resolution condemning the system of concentric wiring, as they believe it does not make for better and safer installations.

The Department of Electricity of San Francisco has recently made a ruling that all wires in conduits in a basement slab must be lead covered.

F. E. Newberry Company of San Francisco, have been awarded the contract for the electrical work in the new Chemistry Building at the University of California, and the McFell Electric Company have the contract for Hilgard Hall.

The Standard Electric Works of San Francisco have the electrical contract for the new Santa Fe Building, Second and Market streets San Francisco.

NEWS NOTES

INCORPORATIONS.

SALEM, ORE.—The Pringle Falls Electric Power Company of La Pine, Ore., has filed articles of incorporation with E. L. Clark, A. D. Lee and F. W. Thomas, incorporations and capital stock of $500,000.

ILLUMINATION.

SANTA BARBARA, CAL.—The question of ornamental lamp posts is again under consideration.

TWIN FALLS, IDAHO.—The Idaho Power Company is to install a new street lighting system here.

FULLERTON, CAL.—The board of trade is considering the matter of installing a system of ornamental lights on Spadra avenue.

LOS ANGELES, CAL.—A request for furnishing lights for Homeward Avenue Lighting District through the county mechanical department, has been granted by the board of supervisors.

SACRAMENTO, CAL.—City Commissioner Thomas Coulter has gone on record in favor of establishing a municipal lighting plant. The city pays the Pacific Gas & Electric Company $70,000 a year for street lighting.

ESCONDIDO, Cal.—At an auction conducted by the Los Angeles Trust & Savings Company, trustee, the plant of the Escondido Utilities Company, making gas and electric current, was sold for $10,000 to Miss Mary K. Wohlford.

SAN LUIS OBISPO, CAL.—The board of supervisors of San Luis Obispo County have called a special election to be held August 29 to vote on the proposed formation of the Margarita Public Highway Lighting District.

BAKER, ORE.—To co-operate in the improvement of Main street when the new combination single standard and cluster lights are installed, the Eastern Oregon Light & Power Company has agreed to remove all its poles from the street.

GOLDFIELD, NEV.—The Globe Gas Company has applied for a franchise to operate a gas heating and lighting system in this city. It is stated that 130 miles of 4 in. and 6 in. pipe has been purchased and that the company plans to lay about nine miles of mains in Goldfield and altogether about 56 miles of pipe.

FRESNO, CAL.—Bids submitted by six electrical firms of the proposed electrolier lighting system in court house square were all rejected. When the county surveyor made his survey he estimated that the total cost would not be in excess of $9500. The smallest bid received was $13,987. Supervisor Johnson made a motion that the entire matter be referred to the county purchasing agent for investigation, his idea being that the county do the work.

LOS ANGELES, CAL.—In connection with the construction of the proposed municipal street lighting system in the East Los Angeles district, including Bairdstown, and the proposed construction of a system in the Hollywood district, the board of public works has asked that the public service commission fix rates for furnishing and maintaining the following classes of service: 1000 c.p. 20-ampere street service lamps, 400 c.p. 15-ampere lamps and 80 c.p. 6.6 ampere lamps, ornamental post lighting on basis of price per kilowatt hour, including current, renewal of lamps and maintenance.

BANNING, CAL.—The Riverside County Gas & Power Company has purchased the Banning and Beaumont Gas plants and distributing systems and in thirty days will take possession of business in both cities. The plant at Beaumont will be rebuilt and a gas supply manufactured at that place, and a high pressure line will be laid to Banning to feed the distributing system. The old gas companies retain an interest in the new company, which has the following officers and directors: President, N. W. Farr; secretary, Farr McComb; vice-president, D. H. Gates; secretary and manager, F. N. Hawes, K. R. Smoot; treasurer, E. D. Reynolds; comptroller, First National Bank of Banning. H. W. Burkhart, is engineer.

TRANSMISSION.

YREKA, CAL.—H. O'Connor and crew are running a survey from Mott to McCloud preparatory to the construction of a power line into the McCloud district.

BAKERSFIELD, CAL.—The Southern Sierra Power Company has applied for a franchise for a transmission line for which the supervisors will receive bids up to September 7th.

GREAT FALLS, MONT.—The Montana Power Company will expend $500,000 on improvements to the plant, adding 13,000 h.p. at Rainbow Falls.

SOUTH BEND, WASH.—The Northwest Electric & Waterworks has ordered clearing of a site for the proposed new 300,000 gallon reservoir near here.

BUTTE, MONT.—An official count of the vote cast by property owners upon the question of granting lighting and heating franchise to the Montana Power Company shows that both franchises carried.

RIVERSIDE, CAL.—The Southern California Edison Company has notified the board of public utilities of its intention to construct a new transmission line to provide the city with an additional circuit.

REDLANDS, CAL.—The sum of $15,000 will be expended by the Pacific Light & Power Company in rebuilding and enlarging the company's power line crossing streams in San Bernardino and Riverside counties, it is stated.

ENTERPRISE, ORE.—Preparations for the construction of the new high voltage transmission line to connect the Joseph plant with the other parts of the system of the Enterprise Electric Company are under way. L. M. Simpson is general manager.

LOS ANGELES, CAL.—The Pacific Power Corporation, subsidiary of the Nevada-California Power Company, is building a large plant on Silver Lake, just north of Owens Valley. The plant, costing approximately $100,000 will generate 16,000 h.p. when completed and will consist of two units. Fred L. Poison, C. B. Poole and E. J. Waugh are in charge of the work.

EUGENE, ORE.—The city of Eugene has a project on foot for the removal of all poles from Willamette street, the principal business thoroughfare of the city. The municipal water board announced today that the poles of the old Oregon Power Company's distributing system, recently purchased by the city, will be removed at once. All poles in connection with the city's electrical plant are in the alleys.

SAN FRANCISCO, CAL.—Contracts have been awarded by the Board of Public Works for the necessary machinery for the Cherry Creek power station that will be part of the Hetch-Hetchy water supply project. The power generated at this station will be utilized in the construction work of

the Hetch-Hetchy dam and in the boring of the water tunnels along the line of the water conduits. The Pelton Water Wheel Company will supply the hydraulic machinery and the generators will be furnished by the General Electric Company.

STOCKTON CAL.—A new electric furnace installed by the Monarch foundry is now operating at full capacity. This is the first electric furnace installed in Stockton, and has proven very satisfactory. Energy is supplied for operation by the Western States Gas & Electric Company. It is estimated that the company's annual revenue from this installation will be upwards of $5000. The Samson Iron Works is now considering the installation of a ¾-ton electric furnace for similar purposes.

SALEM, ORE.—Application to appropriate water from Multnomah and Peterson creeks for power development purposes was filed with State Engineer Lewis by Charles Coopey of Portland. Whether the application can be allowed under the act of the 1915 legislature, which withdrew from appropriation the waters of Multnomah Creek, has been referred to Attorney-General Brown for decision. If the application is granted it is the intention to divert the water from above Multnomah Falls and return it to the creek above the falls. The cost of developing the power project is estimated at $20,000.

WILLIAMS, ARIZ.—It is understood that E. P. Ripley, president of the Santa Fe, and his associates have taken over the Grand Canyon reservoir and hydroelectric project. Plans for this enterprise involve the building of a dam across one of the laterals of the Grand Canyon and the storage of water for operating one of the largest hydroelectric plants in this country, including the irrigation of more than 200,000 acres of land. Electric power transmission lines are expected to be constructed to mining districts, towns and industrial centers within a radius of 200 miles of the generating plant. The dam will be the highest in the world. Some of the engineers are already on the ground. It is understood that permanent surveys will be finished and construction work started before the middle of November.

TRANSPORTATION.

WHITTIER, CAL.—The Pacific Electric Railway Company, has been granted a 50 year franchise on certain portions of Philadelphia street.

SACRAMENTO, CAL.—The Northern Electric Company has been granted permission by the State Reclamation Board to construct a steel bridge across the American River.

GLENDALE, CAL.—Plans are under way to secure a right of way for an extension of the Pacific Electric Railway to a junction with the main Los Angeles line in Tropico.

MISSOULA, MONT.—The Missoula Street Railway Company will extend its line to the site of the proposed factory of the Great Western Sugar Company, same to cost about $25,000.

BREA, CAL.—At a meeting of the chamber of commerce at Brea a committee was appointed to confer with the Pacific Electric Railway asking that company, when it extends its line to Fullerton, to make the extension to Brea.

HELENA, MONT.—Jesse R. Roote, who has been in charge as resident director of the Keating gold property, makes the statement that the proposed electric railway from Toston into the Radersburg district is being surveyed. The proposed road will be 12 miles long.

PORTLAND, ORE.—According to the quarterly statement just issued by the Portland Railway, Light & Power Company the number of cars used by the company was 591. The operating expenses for traffic and lighting was $1,303,853, and operating revenue, $1,356,451, the valuation of its plant is given as $59,387,628.

PORTERVILLE, CAL.—High officials of electric lines, with several prominent business men, have been touring this part of the county, with the admitted object of considering possible routes for new electric lines that may be built here in the future. In the party, besides the Porterville men, were Paul Shoup, president of the Pacific Electric; F. W. Webster, superintendent of the valley electric lines of the Southern Pacific, and W. P. Ballard, superintendent of the Visalia Electric Railway.

TELEPHONE AND TELEGRAPH.

DAYTON, WASH.—The city council has granted the Pacific Telephone & Telegraph Company the right to operate here.

OLYMPIA, WASH.—The Elma Matlock Telephone Company, capialized at $5000, will provide a farmers' telephone system about Elma.

YUBA CITY, CAL.—According to the city assessment roll this year, the Pacific States Telephone & Telegraph Company has 6.2 miles of poles and 320 miles of wire here.

WILCOX, ARIZ.—The superintendent of the Tri-State Telephone Company of El Paso has been in Wilcox to confer with officials of the local telephone company regarding arrangements for the Tri-State company to run a copper wire into the local office and thus afford Wilcox long distance service to El Paso and Los Angeles.

NOGALES, ARIZ.—W. A. Getline and Pat Patterson, residents of Patagonia, have made application to the superviors of Santa Cruz County for a franchise to operate telephone lines along the public highways from Patagonia to Nogales, from Patagonia to Sonoita and Elgin, from Patagonia toward Fairbank, from Patagonia to Harshaw, up Harshaw Canyon and to San Rafael postoffice and vicinity. A public hearing of the application will be held on September 5th.

IRRIGATION.

SALEM, ORE.—State Engineer Lewis and J. T. Whistler of the U. S. Reclamation Service have prepared plans for reclaiming about 6000 acres of land along the White River in Wasco county. This will cost about $1,726,000.

PROSSER, WASH.—O. Laurgaard, who was employed by the Horse Heaven Irrigation District to make investigations concerning the feasibility and cost of the project, has brought in a favorable report, which places the cost at $50 an acre and up.

MADERA, CAL.—Water users of this district have organized and will oppose the attempt of the Madera Canal and Irrigation Company to increase the rates. J. L. Davis has been named president of the Water Users' Association, and Walter Schmitz is secretary-treasurer.

TERRA BELLA, CAL.—At an election held here the electors voted the issuance of $1,000,000 in 30-year 6 per cent bonds for the construction of the Terra Bella Irrigation District. About one-sixth of the area which will be reached by the pumping system is now planted with citrus and olive trees.

REDDING, CAL.—The main canal of the Anderson-Cottonwood Irrigation District, according to James Willison, the contractor, is one-half completed. It is finished from Redding to China Gulch and from Anderson to Cottonwood, with the exception that here and there are places that need a little touching up.

VALE, ORE.—An election was held here recently for the purpose of voting on a proposed issue of $750,000 bonds to construct the Warm Springs irrigation project. It was anticipated that the election would be carried, in which event it is not unlikely that bids for both the bonds and work will be invited soon.

ST. MARIES, IDAHO.—Bids will be received by Court M. Sargent, secretary here, up to noon August 31 for construction work and material for Drainage District No. 2, Benewah county, Idaho. Engineer's estimate of yardage, 120 000 cu. yds.; embankment, 23,000 cu. yds.; ditches. Certified check for 5 per cent of bid required. M. S. Parker, engineer.

ISSAQUAH, WASH.—The commissioners of Drainage District No. 4, Issaquah, Wash., have awarded the contract to the Chamberlain Construction Company, Globe Block, Seattle, for draining about 1000 acres of land in the Issaquah valley for about $11,000. The work involves removal of 50,000 cu. yds. of material.

OAKDALE, CAL.—Litigation is likely to follow the filing of the newly built Strawberry reservoir by the Sierra and San Francisco Power Company. The Oakdale Irrigation District has requested the power company to desist from taking water from the Stanislaus River to fill the reservoir, as the district has title to the flow of the stream, with the exception of 55 second feet.

LINDSAY, CAL.—At the opening of bids for the construction of the Lindsay-Strathmore Irrigation system three bidders were present, and submitted the required certified checks to cover the aggregate amount of figures on their work. Shattuck & Eddinger of Los Angeles presented a check of $140 000; Frank Kennedy of Los Angeles, one for $125,000; the McClemaham-Craner-Carter Company, also of Los Angeles offered $120,000. The bids were taken under advisement.

MADERA, CAL.—The Chowchilla Reclamation District has been formally organized at the meeting of the supervisors. The district will include 79,033.41 acres, this acreage excluding the Bliss ranch of 9600 acres. Of this acreage, 67,593.41 acres are in Madera County and the balance in Merced County. The plan is to confine the waters of the Fresno, Chowchilla rivers and the several sloughs tributary to these rivers and the San Joaquin River, inside their banks, so that they will not overflow as they do now.

SACRAMENTO, CAL.—The reorganization and ultimate completion of an irrigation project, formerly known as the central irrigation canal and more recently known as the Kuhn project, for irrigating 200,000 acres in the counties of Colusa and Glenn, seems now an assured fact. The interests of the Kuhns have been eliminated through foreclosures and a system is now developing, under direction of D. W. Ross, that will eventually comprise an area of 215 000 acres, bounded on the east by the Sacramento River and on the west by the central canal of the district. Mr. Ross states that there are 25,000 acres under irrigation this year in the district.

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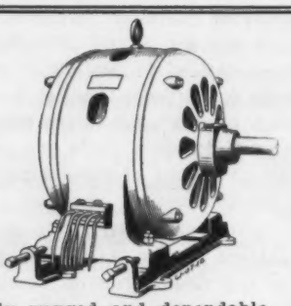
Wagner Quality



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Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX
Number 12

	List.	Sell.
¾-Inch.		
21, 1 Wire	.15	.15
22, 2 Wire	.15	.15
23, 3 Wire	.15	.15
2400, 4 Wire	.15	.15
24, For W. P. Socket	.25	.25
25, ⅛ Metal Male Nipple	.25	.25
26, ⅛ Metal Female Nipple	.25	.25
27, ⅜ Metal Male Nipple	.30	.30
28, ⅜ Metal Female Nipple	.30	.30
29, ⅛ Porc. Male Nipple	.30	.30
210, ⅛ Porc. Female Nipple	.30	.30
211, ⅜ Porc. Male Nipple	.41	.45
212, ⅜ Porc. Female Nipple	.41	.45
200, Blank Metal Cover	.11	.15
1-Inch.		
31, 1 Wire	.25	.25
32, 2 Wire	.25	.25
33, 3 Wire	.25	.25
3400, 4 Wire	.25	.25
34, For W. P. Socket	.40	.40
35, ⅛ Metal Male Nipple	.35	.35
36, ⅛ Metal Female Nipple	.35	.35
37, ⅜ Metal Male Nipple	.40	.40
38, ⅜ Metal Female Nipple	.40	.40
39, ⅛ Porc. Male Nipple	.43	.45
310, ⅛ Porc. Female Nipple	.43	.45
311, ⅜ Porc. Male Nipple	.53	.55
312, ⅜ Porc. Female Nipple	.53	.55
300, Blank Metal Cover	.23	.25
1¼-Inch.		
42, 2 Wire	.36	.40
43, 3 Wire	.36	.40
4400, 4 Wire	.36	.40
4500, 5 Wire	.36	.40
4600, 6 Wire	.36	.40
400, Blank Metal	.32	.35
1½-Inch.		
52, 2 Wire	.48	.50
53, 3 Wire	.48	.50
5400, 4 Wire	.48	.50
5500, 5 Wire	.48	.50
5600, 6 Wire	.48	.50
5700, 7 Wire	.48	.50
500, Blank Metal	.45	.45
2-Inch.		
63, 3 Wire	.60	.60
600, Blank Metal	.50	.60
2½-Inch.		
73, 3 Wire	.80	.80
700, Blank Metal	.75	.75
3-Inch.		
83, 3 Wire	.80	.80

The correctness of these suggested selling prices is not guaranteed by the publisher. Suggestions for corrections are invited.

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Journal of Electricity, Power and Gas
ELECTRICAL PRICE INDEX
Number 11

Type "LF"-"LB"-"LR"-"LL"—Without Covers, but With Cover Screws.

Cat. No.	List.	Sell.
L-11-F, ½ in.	.40	.40
L-22-F, ¾ in.	.45	.45
L-33-F, 1 in.	.65	.65
Type "T."		
T-111, ½ x ½ x ½	.48	.50
T-121, ½ x ¾ x ½	.56	.60
T-131, ½ x 1 x ½	.63	.65
T-212, ¾ x ½ x ¾	.57	.60
T-222, ¾ x ¾ x ¾	.57	.60
T-232, ¾ x 1 x ¾	.65	.65
T-242, ¾ x 1¼ x ¾	.77	.80
T-313, 1 x ½ x 1	.80	.80
T-323, 1 x ¾ x 1	.80	.80
T-333, 1 x 1 x 1	.80	.80
Types "TR"-"TL"		
T-111-R, ½ x ½ x ½	.48	.50
T-121-R, ½ x ¾ x ½	.56	.60
T-222-R, ¾ x ¾ x ¾	.57	.60
T-333-R, 1 x 1 x 1	.80	.80
Type "V"—Complete.		
1089, ½ x 2¾ x 5¼	4.50	4.50
2089, ¾ x 2¾ x 5¼	4.55	4.70
H-1089, ½ x 3¾ x 7¾	5.40	.....
H-2089, ¾ x 3¾ x 7¾	5.45	.....
Type "X."		
X-1111, ½ x ½ x ½	.60	.60
X-2222, ¾ x ¾ x ¾	.77	.80
X-3333, 1 x 1 x 1	1.05	1.05
COVERS. ½-Inch.		
11, I Wire	.10	.10
12, 2 Wire.	.10	.10
13, 3 Wire	.10	.10
1400, 4 Wire	.10	.10
14, For W. P. Socket	.16	.20
15, ⅛ Metal Male Nipple	.20	.20
16, ⅛ Metal Female Nipple	.20	.20
17, ⅜ Metal Male Nipple	.25	.25
18, ⅜ Metal Female Nipple	.25	.25
19, ⅛ Porc. Male Nipple	.25	.25
112, ⅜ Porc. Female Nipple	.35	.35
110, ⅛ Porc. Female Nipple	.25	.25
111, ⅜ Porc. Male Nipple	.35	.35
100, Blank Metal Cover	.10	.10
100, Blank Metal Cover	.08	.10

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ALPHABETICAL INDEX TO ADVERTISERS

The letter and number before each name are used in the classified page following

A-1 **American Ever-Ready Works of National Carbon Co.**
Los Angeles; 755 Folsom St., San Francisco; Seattle.

A-2 **Atchison, Topeka & Santa Fe Railway Co**
673 Market St., San Francisco; 1218 Broadway, Oakland.

B-1 **Baker-Joslyn Company** 4
71 New Montgomery St., San Francisco; 911 Western Ave., Seattle; 353 E. Second St., Los Angeles.

B-2 **Benjamin Electric Manufacturing Co**
590 Howard St., San Francisco.

C-1 **Century Electric Co** 3
906 So. Hope St., Los Angeles; 56 Natoma St., San Francisco; 65 Front St., Portland, Ore.

C-3 **Crocker-Wheeler Co**
87 New Montgomery St., San Francisco; 228 Central Avenue, Los Angeles.

C-4 **Cutler-Hammer Manufacturing Co** 5
579 Howard St., San Francisco; Morgan Bldg., Portland, Ore.; San Fernando Bldg., Los Angeles.

D-4 **Davis Slate & Manufacturing Co** 13
Chicago, Ill.

D-2 **Dearborn Drug and Chemical Works** 13
355 East Second St., Los Angeles; 301 Front St., San Francisco.

E-7 **Economy Fuse & Mfg. Co**
Kinzie and Orleans Sts., Chicago.

E-1 **Edison Lamp Works of General Electric Co**
Rialto Bldg., San Francisco; 724 So. Spring St., Los Angeles.

E-2 **Edison Storage Battery Supply Co** 13
441 Golden Gate Ave., San Francisco.

E-3 **Electric Agencies Co**
247 Minna Street, San Francisco; Central Building, Los Angeles.

E-6 **Electric Novelty Works**
533 Mission St., San Francisco.

E-4 **Electric Storage Battery Co**
743 Rialto Bldg., San Francisco.

E-5 **Electric, Railway & Manufacturing Supply Co.** 13
34 Second St., San Francisco.

F-1 **Fairbanks, Morse & Co**
Los Angeles; Portland; 651 Mission St., San Francisco; Seattle; Spokane.

F-3 **Federal Sign System (Electric)** 11
618 Mission St., San Francisco.

G-1 **General Electric Co** 12
724 So. Spring St., Los Angeles; Worcester Bldg., Portland; Rialto Bldg., San Francisco; Colman Bldg., Seattle; Paulsen Bldg., Spokane.

G-1 **General Vehicle Co**
1117 Van Ness Ave., San Francisco; 331 Wall St., Los Angeles; British Columbia Electric Ry., Ltd., Vancouver, B. C.

H-1 **Habirshaw Electric Cable Co., Inc**
(See Western Electric Company.)

H-2 **Hemingray Glass Co** 13
236-240 So. Los Angeles St., Los Angeles; 345 Oak St., Portland; 807 Mission St., San Francisco.

H-3 **Haller-Cunningham Electric Co**
428 Market St., San Francisco.

H-5 **Hunt, Mirk & Co**
141 Second St., San Francisco.

H-7 **Hurley Machine Co** 2
New York and Chicago. (See Pacific States Electric Co.

I-2 **Illinois Electric Co**
261-263 So. Los Angeles St., Los Angeles.

I-3 **Interstate Electric Novelty Co**
111 New Montgomery St., San Francisco.

L-1 **Leahy Manufacturing Co** 13
Eighth and Alameda St., Los Angeles.

L-2 **Locke Insulator Manufacturing Co** 7
(See Pierson, Roeding & Co.)

M-2 **McGlauflin Manufacturing Co** 13
San Rafael, Cal.

M-4 **Morse Chain Company**
Monadnock Bldg., San Francisco.

M-3 **Moore & Co., Charles C** 3
Van Nuys Bldg., Los Angeles; Spalding Bldg., Portland; Kearns Bldg., Salt Lake City; Sheldon Bldg., San Francisco; Mutual Life Bldg., Seattle; Santa Rita Hotel Bldg., Tucson.

N-1 **Nason & Co., R. N**
151 Potrero Ave., San Francisco.

N-6 **National Carbon Company** 14
Cleveland, Ohio.

N-2 **National Conduit & Cable Co., The**
Trust and Savings Bldg., Los Angeles; Rialto Bldg., San Francisco.

N-3 **National Lamp Works of G. E. Co**
(All Jobbers.)

N-4 **New York Insulated Wire Co**
629 Howard St., San Francisco.

N-5 **Northwestern Pacific Railroad**
808 Phelan Bldg., San Francisco.

O-1 **Okonite Co. (The)** 14
(All Jobbers.)

P-1 **Pacific Electric Manufacturing Co**
80 Tehama St., San Francisco.

P-2 **Pacific States Electric Co** 2
236-240 So. Los Angeles St., Los Angeles; 61-67 Fifth St. No., Portland; 200-210 Twelfth St., Oakland; 575 Mission St., San Francisco; 307 First Ave. So., Seattle.

P-4 **Pelton Water Wheel Co** 13
2219 Harrison St., San Francisco.

P-5 **Pierson, Roeding & Co**
Pacific Electric Bldg., Los Angeles; Rialto Bldg., San Francisco; Colman Bldg., Seattle.

P-6 **Pittsburgh Electric Specialties Company**
202 Aronson Bldg., San Francisco.

P-7 **Pittsburgh Piping & Equipment Co** 14
Monadnock Bldg., San Francisco.

S-1 **Schaw-Batcher Company, Pipe Works, The**
211 J St., Sacramento; 356 Market St., San Francisco.

S-4 **Southern Pacific Co** 3
Flood Bldg., San Francisco

S-5 **Sprague Electric Works** 14
Rialto Bldg., San Francisco; Colman Bldg., Seattle; Corporation Bldg., Los Angeles; Electric Bldg., Portland; Paulsen Bldg., Spokane.

S-6 **Standard Underground Cable Co** 14
First National Bank Bldg., San Francisco; Hibernian Bldg., Los Angeles; Central Bldg., Seattle, Wash.; 815 Newhouse Bldg., Salt Lake City, Utah.

T-1 **Thomas & Co., R**
Pacific States Electric Co. and Western Electric Co., Pacific Coast Representatives.

T-2 **Tubular Woven Fabric Company** 4
Pawtucket, R I.

U-1 **United Sheet Metal Works**
575 Howard St., San Francisco.

W-1 **Wagner Electric Manufacturing Company** 7
St. Louis, Mo.

W-2 **Western Electric Co**
Eighth and Santee Sts., Los Angeles; 1900 Telegraph Ave., Oakland, Cal.; 680 Folsom St., San Francisco; 907 First Ave., Seattle; 45 North Fifth St., Portland, Ore.

W-3 **Ward-Leonard Electric Co** 14
Mt. Vernon, New York.

W-4 **Westinghouse Electric and Manufacturing Co** 6
50-52 East Broadway, Butte; Van Nuys Bldg., Los Angeles; Couch Bldg., Portland; 212 So. W. Temple, Salt Lake City; 165 Second St., San Francisco; Second and Cherry Sts., Seattle; Paulsen Bldg., Spokane.

W-5 **Westinghouse Machine Co**
141 Second St., San Francisco.

W-6 **Westinghouse Lamp Co**
(See Westinghouse Electric & Manufacturing Co.)

W-8 **Western Pipe & Steel Co**
444 Market St., San Francisco; 1758 North Broadway, Los Angeles